QSTIMATING CASE STUDY

From Borehole Log to Buildable Risk

Turning a ground investigation report into a rock-breaking productivity model and a live planning-noise risk assessment

10	5,000m³	5	65dB(A)
ROTARY CORES ANALYSED	ROCK TO BE BROKEN OUT	BREAKING CLASSES DERIVED	FACADE NOISE LIMIT IN PLAY

THE STARTING POINT

A Ground Investigation report is not a price. It's 60-odd pages of borehole logs, TCR/SCR/RQD numbers and fracture descriptions; written by geotechnical engineers for geotechnical purposes, not for a contractor trying to work out how many weeks a 60-tonne breaker needs on site, or whether that breaker can even run without breaching a planning condition.

This project - a basement excavation into Visean Limestone at the rear of an existing college library, is a case in point. The GI report gave ten rotary core logs (RC01–RC10), each with TCR, SCR and RQD readings at multiple depths, strength descriptions, and fracture spacing notes. None of that is directly usable in a BoQ. Turning it into one is the job.

Why this matters to a contractor QS: the same ten core logs that tell a structural engineer where to found the building also tell an estimator exactly where the rock will fight back, and cross-referenced against the site's noise condition, exactly where that fight becomes a compliance problem rather than just a productivity one.

1 How hard will this be to break?

RQD, SCR and TCR describe fracturing, not strength directly, but fracturing is what actually governs breaker productivity. Intensely fractured rock (low RQD) liberates fast under a bucket or light breaker; intact rock needs sustained, full-power breaking.

2 Where does that breach the noise condition?

The planning drawing carried a standard condition: 65 dB(A), 15-min LAeq at the most exposed facade. With a 10–40m working envelope, a 60t breaker at full effort is 20–30 dB(A) over limit.

THE APPROACH — THREE PASSES OVER THE SAME TEN LOGS

1
EXTRACT
Depth to rockhead, weathered top/base, competent rock top - read straight off each RC log, m BGL.

2
CLASSIFY
RQD/SCR/TCR run through a breaking-effort scale - self-liberating through to heavy breaking.

3
CROSS-REFERENCE
Each breaking class mapped against estimated dB(A) at the site's real 10m and 40m facades.

RQD is the discriminator. Two cores returned RQD = 0% at rockhead, the rock is present but essentially pre-broken. One core returned RQD 89% at depth, intact limestone taking full breaker effort throughout. A five-band classification was built directly from RQD/SCR thresholds and checked against the Pettifer & Fookes (1994) excavatability graph the GI report itself references.

Class	Trigger	Rate
Self-liberating	RQD=0%, SCR≤10%	60–100 m^3/hr
Rippable	RQD≤25%, SCR≤35%	45–70 m^3/hr
Moderate	RQD 25–50%	25–45 m^3/hr
Full breaking	RQD 50–75%	15–25 m^3/hr
Heavy / hard rock	RQD > 75%	8–15 m^3/hr

THE INSIGHT THIS PRODUCES

Two of the ten cores (RC02, RC05) sit in genuinely self-liberating ground, likely workable without the breaker at all, which is good for both programme and noise compliance.

Three others (RC07, RC08, RC09) are hard rock from rockhead, the highest-risk zones for both productivity and enforcement action, and the ones a tender methodology needs to address explicitly rather than average away.

THE OUTPUT - A WORKING RISK REGISTER

The end product isn't a single average breaking rate for 5,000m³; that number would hide exactly the variation that drives both cost and compliance risk. It's a hole-by-hole table: depth to rock, breaking class, indicative production rate, and the corresponding noise risk, all traceable back to the two figures in the original GI log: RQD and SCR, that some estimators skim past.

Core	Weathered Zone Class	Competent Zone Class	Noise Risk
RC05	**Self-liberating**	**Moderate–Full**	Manageable at 40m; still marginal at 10m
RC04 / RC06 / RC10	**Rippable**	**Moderate–Full**	Breach at both distances; hoarding + short bursts
RC01 / RC03	**Moderate**	**Full**	Breach; CNMP-level mitigation needed
RC02 / RC07 / RC08 / RC09	**Full–Heavy**	**Full–Heavy**	Significant breach; negotiated relaxation required

> *"The number that actually changes the price isn't the average RQD across ten boreholes; it's knowing which three of those boreholes sit hard against the boundary with RQD over 50%, because that's where the programme slips and the noise complaint lands."*

WHY THIS APPROACH, NOT A SINGLE AVERAGE RATE

- **Every figure traces to a logged RQD/SCR value**
- **Zone-by-zone, not site-average**
- **Noise risk sits next to productivity**
- **Flags data gaps rather than hiding them**

WHAT THIS MEANS FOR A TENDER

Structured this way, the GI report stops being 60 pages the estimator has to read once and remember, and becomes a live reference that sits underneath the price: which zones are quick, which need real breaker time, where the acoustic hoarding actually needs to go, and where a qualification belongs in the tender return rather than a risk absorbed silently into the rate.

Where this is heading: the same triage; depth extraction, index-driven classification, geometry cross-reference, is repeatable across any GI report with rotary core data. The next step is templating the classification thresholds so a new set of core logs produces this same output automatically, rather than being rebuilt by hand each time.

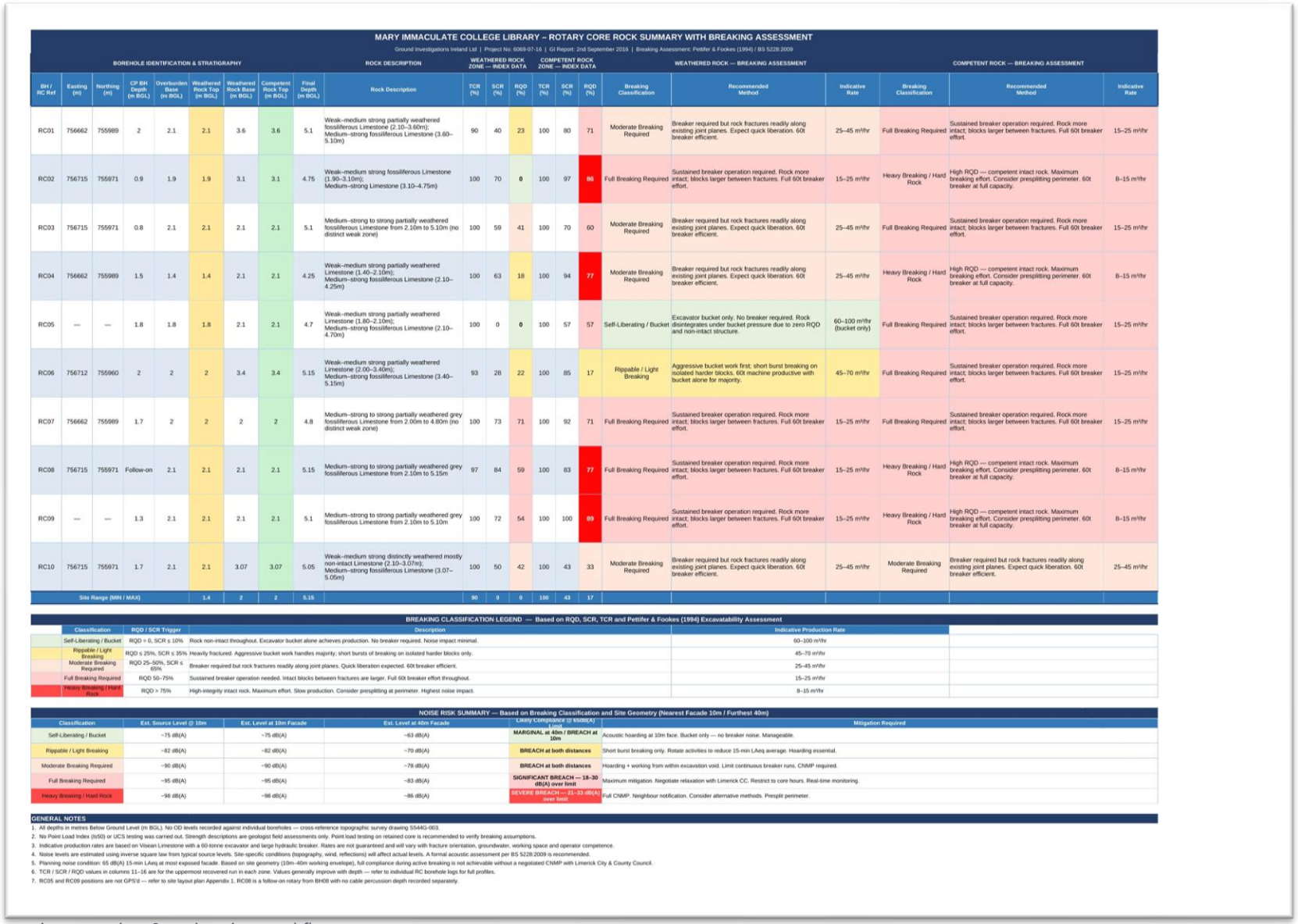
XLS

Full Output - Rotary Core Rock Summary Workbook

Hole-by-hole breaking classification, recommended method, indicative production rate and noise risk mapping for all 10 rotary cores; the working file behind this case study, colour-coded and cross-referenced against the site's planning noise condition.

FULL OUTPUT — ROTARY CORE ROCK SUMMARY WORKBOOK

Hole-by-hole breaking classification, recommended method, indicative production rate and noise risk mapping for all 10 rotary cores — the working file behind this case study.



MARY IMMACULATE COLLEGE LIBRARY – ROTARY CORE ROCK SUMMARY WITH BREAKING ASSESSMENT

Ground Investigations Ireland Ltd | Project No: 6069-07-16 | GI Report: 2nd September 2016 | Breaking Assessment: Pettifer & Fookes (1994) / BS 5228:2009

BOREHOLE IDENTIFICATION & STRATIGRAPHY									ROCK DESCRIPTION	WEATHERED ROCK ZONE — INDEX DATA			COMPETENT ROCK ZONE — INDEX DATA			WEATHERED ROCK — BREAKING ASSESSMENT			COMPETENT ROCK — BREAKING ASSESSMENT		
BH / RC Ref	Easting (m)	Northing (m)	CP BH Depth (m BGL)	Overburden Base (m BGL)	Weathered Rock Top (m BGL)	Weathered Rock Base (m BGL)	Competent Rock Top (m BGL)	Final Depth (m BGL)	Rock Description	TCR (%)	SCR (%)	RQD (%)	TCR (%)	SCR (%)	RQD (%)	Breaking Classification	Recommended Method	Indicative Rate	Breaking Classification	Recommended Method	Indicative Rate
RC01	756662	755989	2	2.1	2.1	3.6	3.6	5.1	Weak–medium strong partially weathered fossiliferous Limestone (2.10–3.60m); Medium–strong fossiliferous Limestone (3.60–5.10m)	90	40	23	100	80	71	Moderate Breaking Required	Breaker required but rock fractures readily along existing joint planes. Expect quick liberation. 60t breaker efficient.	25–45 m³/hr	Full Breaking Required	Sustained breaker operation required. Rock more intact; blocks larger between fractures. Full 60t breaker effort.	15–25 m³/hr
RC02	756715	755971	0.9	1.9	1.9	3.1	3.1	4.75	Weak–medium strong fossiliferous Limestone (1.90–3.10m); Medium–strong Limestone (3.10–4.75m)	100	70	0	100	97	86	Full Breaking Required	Sustained breaker operation required. Rock more intact; blocks larger between fractures. Full 60t breaker effort.	15–25 m³/hr	Heavy Breaking / Hard Rock	High RQD — competent intact rock. Maximum breaking effort. Consider presplitting perimeter. 60t breaker at full capacity.	8–15 m³/hr
RC03	756715	755971	0.8	2.1	2.1	2.1	2.1	5.1	Medium–strong to strong partially weathered fossiliferous Limestone from 2.10m to 5.10m (no distinct weak zone)	100	59	41	100	70	60	Moderate Breaking Required	Breaker required but rock fractures readily along existing joint planes. Expect quick liberation. 60t breaker efficient.	25–45 m³/hr	Full Breaking Required	Sustained breaker operation required. Rock more intact; blocks larger between fractures. Full 60t breaker effort.	15–25 m³/hr
RC04	756662	755989	1.5	1.4	1.4	2.1	2.1	4.25	Weak–medium strong partially weathered Limestone (1.40–2.10m); Medium–strong fossiliferous Limestone (2.10–4.25m)	100	63	18	100	94	77	Moderate Breaking Required	Breaker required but rock fractures readily along existing joint planes. Expect quick liberation. 60t breaker efficient.	25–45 m³/hr	Heavy Breaking / Hard Rock	High RQD — competent intact rock. Maximum breaking effort. Consider presplitting perimeter. 60t breaker at full capacity.	8–15 m³/hr
RC05	—	—	1.8	1.8	1.8	2.1	2.1	4.7	Weak–medium strong partially weathered Limestone (1.80–2.10m); Medium–strong fossiliferous Limestone (2.10–4.70m)	100	0	0	100	57	57	Self-Liberating / Bucket	Excavator bucket only. No breaker required. Rock disintegrates under bucket pressure due to zero RQD and non-intact structure.	60–100 m³/hr (bucket only)	Full Breaking Required	Sustained breaker operation required. Rock more intact; blocks larger between fractures. Full 60t breaker effort.	15–25 m³/hr
RC06	756712	755960	2	2	2	3.4	3.4	5.15	Weak–medium strong partially weathered Limestone (2.00–3.40m); Medium–strong fossiliferous Limestone (3.40–5.15m)	93	28	22	100	85	17	Rippable / Light Breaking	Aggressive bucket work first; short burst breaking on isolated harder blocks. 60t machine productive with bucket alone for majority.	45–70 m³/hr	Full Breaking Required	Sustained breaker operation required. Rock more intact; blocks larger between fractures. Full 60t breaker effort.	15–25 m³/hr
RC07	756662	755989	1.7	2	2	2	2	4.8	Medium–strong to strong partially weathered grey fossiliferous Limestone from 2.00m to 4.80m (no distinct weak zone)	100	73	71	100	92	71	Full Breaking Required	Sustained breaker operation required. Rock more intact; blocks larger between fractures. Full 60t breaker effort.	15–25 m³/hr	Full Breaking Required	Sustained breaker operation required. Rock more intact; blocks larger between fractures. Full 60t breaker effort.	15–25 m³/hr
RC08	756715	755971	Follow-on	2.1	2.1	2.1	2.1	5.15	Medium–strong to strong partially weathered grey fossiliferous Limestone from 2.10m to 5.15m	97	84	59	100	83	77	Full Breaking Required	Sustained breaker operation required. Rock more intact; blocks larger between fractures. Full 60t breaker effort.	15–25 m³/hr	Heavy Breaking / Hard Rock	High RQD — competent intact rock. Maximum breaking effort. Consider presplitting perimeter. 60t breaker at full capacity.	8–15 m³/hr
RC09	—	—	1.3	2.1	2.1	2.1	2.1	5.1	Medium–strong to strong partially weathered grey fossiliferous Limestone from 2.10m to 5.10m	100	72	54	100	100	89	Full Breaking Required	Sustained breaker operation required. Rock more intact; blocks larger between fractures. Full 60t breaker effort.	15–25 m³/hr	Heavy Breaking / Hard Rock	High RQD — competent intact rock. Maximum breaking effort. Consider presplitting perimeter. 60t breaker at full capacity.	8–15 m³/hr
RC10	756715	755971	1.7	2.1	2.1	3.07	3.07	5.05	Weak–medium strong distinctly weathered mostly non-intact Limestone (2.10–3.07m); Medium–strong fossiliferous Limestone (3.07–5.05m)	100	50	42	100	43	33	Moderate Breaking Required	Breaker required but rock fractures readily along existing joint planes. Expect quick liberation. 60t breaker efficient.	25–45 m³/hr	Moderate Breaking Required	Breaker required but rock fractures readily along existing joint planes. Expect quick liberation. 60t breaker efficient.	25–45 m³/hr
Site Range (MIN / MAX)					1.4	2	2	5.15		90	0	0	100	43	17						

BREAKING CLASSIFICATION LEGEND — Based on RQD, SCR, TCR and Pettifer & Fookes (1994) Excavatability Assessment

Classification	RQD / SCR Trigger	Description	Indicative Production Rate
Self-Liberating / Bucket	RQD = 0, SCR ≤ 10%	Rock non-intact throughout. Excavator bucket alone achieves production. No breaker required. Noise impact minimal.	60–100 m³/hr
Rippable / Light Breaking	RQD ≤ 25%, SCR ≤ 35%	Heavily fractured. Aggressive bucket work handles majority; short bursts of breaking on isolated harder blocks only.	45–70 m³/hr
Moderate Breaking Required	RQD 25–50%, SCR ≤ 65%	Breaker required but rock fractures readily along joint planes. Quick liberation expected. 60t breaker efficient.	25–45 m³/hr
Full Breaking Required	RQD 50–75%	Sustained breaker operation needed. Intact blocks between fractures are larger. Full 60t breaker effort throughout.	15–25 m³/hr
Heavy Breaking / Hard Rock	RQD > 75%	High-integrity intact rock. Maximum effort. Slow production. Consider presplitting at perimeter. Highest noise impact.	8–15 m³/hr

NOISE RISK SUMMARY — Based on Breaking Classification and Site Geometry (Nearest Facade 10m / Furthest 40m)

Classification	Est. Source Level @ 10m	Est. Level at 10m Facade	Est. Level at 40m Facade	Likely Compliance @ 65dB(A) Limit	Mitigation Required
Self-Liberating / Bucket	~75 dB(A)	~75 dB(A)	~63 dB(A)	MARGINAL at 40m / BREACH at 10m	Acoustic hoarding at 10m face. Bucket only — no breaker noise. Manageable.
Rippable / Light Breaking	~82 dB(A)	~82 dB(A)	~70 dB(A)	BREACH at both distances	Short burst breaking only. Rotate activities to reduce 15-min LAeq average. Hoarding essential.
Moderate Breaking Required	~90 dB(A)	~90 dB(A)	~78 dB(A)	BREACH at both distances	Hoarding + working from within excavation void. Limit continuous breaker runs. CNMP required.
Full Breaking Required	~95 dB(A)	~95 dB(A)	~83 dB(A)	SIGNIFICANT BREACH — 18–30 dB(A) over limit	Maximum mitigation. Negotiate relaxation with Limerick CC. Restrict to core hours. Real-time monitoring.
Heavy Breaking / Hard Rock	~98 dB(A)	~98 dB(A)	~86 dB(A)	SEVERE BREACH — 21–33 dB(A) over limit	Full CNMP. Neighbour notification. Consider alternative methods. Presplit perimeter.

GENERAL NOTES

1. All depths in metres Below Ground Level (m BGL). No OD levels recorded against individual boreholes — cross-reference topographic survey drawing SS44G-003.
2. No Point Load Index (Is50) or UCS testing was carried out. Strength descriptions are geologist field assessments only. Point load testing on retained core is recommended to verify breaking assumptions.
3. Indicative production rates are based on Visean Limestone with a 60-tonne excavator and large hydraulic breaker. Rates are not guaranteed and will vary with fracture orientation, groundwater, working space and operator competence.
4. Noise levels are estimated using inverse square law from typical source levels. Site-specific conditions (topography, wind, reflections) will affect actual levels. A formal acoustic assessment per BS 5228:2009 is recommended.
5. Planning noise condition: 65 dB(A) 15-min LAeq at most exposed facade. Based on site geometry (10m–40m working envelope), full compliance during active breaking is not achievable without a negotiated CNMP with Limerick City & County Council.
6. TCR / SCR / RQD values in columns 11–16 are for the uppermost recovered run in each zone. Values generally improve with depth — refer to individual RC borehole logs for full profiles.
7. RC05 and RC09 positions are not GPS'd — refer to site layout plan Appendix 1. RC08 is a follow-on rotary from BH08 with no cable percussion depth recorded separately.

QStimating

AI-assisted quantity surveying & estimating workflows

qstimating.ie